The New DOE and the Nuclear Fuel Cycle

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President Obama's announcement of his "Energy Team", including Dr. Stephen Chu as the Secretary of Energy, leads one to the conclusion that there will be a strong focus on clean energy production. This will likely include begrudged support for the role nuclear power must play. As reported in a 2005 interview in the UC Berkley News, Dr. Chu "expressed support for the expanded use of nuclear power and for a closed fuel cycle" with hinted opposition to the Yucca Mountain repository program.

Given that perspective, Dr. Chu and President Obama might then favor a "rationalized"(1) nuclear fuel cycle such as that proposed by my co-authors and me in a paper presented at the nuclear waste management conference, WM'03 Symposium, in Tucson, Arizona (2). The key elements of our approach then and, as modified to match today's situation, remain to minimize risk to the public and the environment, maximize resource(fuel) utilization, minimize volumes of nuclear waste for disposal, retain maximum fuel cycle flexibility, and contribute substantially to U.S. energy independence . The deliberations of the Blue Ribbon Commission on America's Nuclear Future and its impending report could greatly influence the nation's opportunities and actions for creating a sustainable, abundant nuclear energy enterprise to sustain the U.S. economy for the long term.

A Rationalized Approach

Regrettably, today nuclear power contributes only about 20 percent of U. S. electricity demand as we confront yet another "energy crisis". Over 65 percent of our oil needs come from foreign sources, and U. S. troops are deployed in the most unstable sector of the world to assure our access to those sources of oil. In addition, we confront the postulated specter of global warning caused by fossil fuel use, while continuing to impede the expansion of nuclear power that is needed to sustain our economy and way of life; this impedance is based largely on the premise that there is no solution for the safe management and/or disposal of spent nuclear fuel (SNF) and high level radioactive waste (HLW).

While mandated by federal law, underpinned by scientific research and encouraged by proven technical feasibility, the nation's commercial nuclear waste repository program has failed to meet our national needs. The U.S. Department of Energy (DOE) just recently announced, after having spent about 26 years and $11 billion to investigate a repository site at Yucca Mountain Nevada, that the SNF/HLW repository could not open before the year 2020 at the earliest. Furthermore, President Obama and his Secretary of Energy, Dr. Stephen Dr. Chu committed to Nevada Senator Harry Reid, not to support the Yucca Mountain repository licensing effort (a commitment that has been kept), thereby exacerbating the lack of a coherent national policy for a complete (closed) nuclear fuel cycle.

I am proposing to enable an increased role of nuclear power in our nation's energy supply portfolio by **rationalizing** the nuclear fuel cycle. In Webster's Dictionary, one can find too frequently applied definitions of rationalize: 1) to apply the principles of scientific management for a desired result, or 2) to provide plausible but untrue reasons for past and ongoing conduct. Any reader who has teenage children is certainly familiar with the applications of definition number 2, and I find that that seems to be the definition that has most recently (in the past two decades) been applied in our national efforts to formulate and implement a national energy policy. What then can we do to redress this situation by applying my preferred definition (1 above) to **rationalize** the nuclear fuel cycle in order to contribute to the growth of nuclear power and enhance our national energy security?

I offer the following observations and recommendations:

1. We must redefine the argument that there is no proof of concept for a nuclear waste repository as a rationale for the Yucca Mountain project. Proof of concept has already been demonstrated at the WIPP site beginning in 1996 when final disposal of nuclear wastes from the nation's nuclear weapons programs was successfully initiated . . . meaning that there is no immediate need for another SNF/HLW repository.
2. Disposal of once-through SNF is counter to establishing a complete, closed nuclear fuel cycle which results in the efficient utilization of the energy from low-enriched uranium fueled nuclear power plants; thus, we must re-establish a commercial nuclear fuel reprocessing/recycling enterprise to sustain our nuclear power capabilities.
3. The goals for national energy security must be supported by the focused expansion of nuclear power supplied electricity, which is dependent upon a closed nuclear fuel cycle. This fuel cycle must of necessity include storage, reprocessing and volume-reduced HLW disposal.
4. To optimize the investments made and the experience gained at the YM site to date, the mission of the YM site should be changed from being the nation's first SNF/HLW repository to being the nation's first federally monitored **retrievable storage (MRS) site.**
5. The DOE should take title to SNF from the utilities much earlier than 2020, which would reduce the utilities' damage claims. To minimize proliferation and terrorist threats/concerns and the environmental impact of an accidental

release of radionuclides/isotopes, the SNF should be stored in the **MRS** mentioned in item 4. above. Successful MRS facility designs have been implemented in Finland and Sweden during the past 20 years.

6. As demonstrated at the WIPP site and in Germany, rock salt is a preferred and very suitable medium for safe containment and isolation of HLW. However, as indicated in item 1. above, local acceptance may be the deciding factor. Hence, local acceptance should be verified before a site is selected.

7. To counter the publics distrust of federal government solutions to energy and environmental problems establish a commercial/private organization (TVA-like) with strong utility representation for the development of the nation's first SNF/HLW repository by the year 2025. An expansion of the mission at the current WIPP facility and/or a WIPP#2 should be an option considered by the commercial entity.

The approach to be taken to resolve the policy or socio-political failures to address the nuclear energy supply problem requires a holistic and technically achievable (rationalized) nuclear fuel cycle.

That **"rationalized"** approach would include a timely commitment to construct a spent nuclear fuel reprocessing/recycling facility to recover the remaining energy in the fuel and volume reduce and vitrify (solidify) the true HLW constituents.

This vitrified material could then be shipped to the existing long-lived radioactive waste disposal facility in the bedded salt formation at the Waste Isolation Pilot Plant facility in southeast New Mexico. To ready the SNF for reprocessing, it could be

stored for a defined number of years to reduce heat, loading and radioactivity levels at the Yucca Mountain facility once it has appropriately been reclassified and licensed as a **monitored retrievable storage** facility.

The technologies are available, the sites are characterized and the licensing processes are well defined. We can accomplish this approach within the next ten to fifteen years.

References

1. Webster's New Collegiate Dictionary
2. "A Holistic Approach for the Disposition of Long-Lived Radioactive Materials", WM'03 Conference, February 23-27, 2003, Tucson, AZ; authors, George E. Dials; Leif Eriksson, international nuclear waste repository consultant; and Dr. Frank Parker, Nuclear Engineering Professor Emeritus, Vanderbilt University.
3. "The International Implications of High Level Radioactive Waste Management in Western Europe", Nuclear Engineering and Political Science Joint Masters Thesis: George E. Dials, Massachusetts Institute of Technology, Cambridge MA, May 1973